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THE SCOLITANTIDINI

I: TWO NEW GENERA AND A GENERIC REARRANGEMENT. (*LYCAENIDAE*)

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ALTHOUGH I HAVE BEEN WORKING WITH "PHILOTES" for over thirty years, it was apparent after the first few months of casual study that the then available arrangements of circumscribed species was incorrect. At the time, the McDunnough (1938) list of North American species included *Philotes battoides* (*Behr*) 1867, *P. glaucon* (Edw.) 1871, *P. enoptes* (Bois.) 1852, *P. mojave* (Watson & Comstock) 1920, *P. spaldingi* B. & McD. 1917, *P. rita* B. & McD. 1916, *P. speciosa* (Henry Edwards) 1876, *P. sonorensis* F. & F. 1865. *Lycaena regia,* Bois. (1869), a synonym of *P. sonorensis,* was the type species Scudder (1876) designated in erecting the genus. The arrangement of species concepts has been maintained by most recent workers, incorporating the recognition of *glaucon* as a subspecies of *battoides* following my diagnosis (1945).

Based upon criteria of facies, habit, and male genitalia, *P. sonorensis* appeared widely separated from *P. speciosa,* with both quite clearly differentiated from the remaining group of *battoides, enoptes, mojave, spaldingi,* and *rita.* In 1945, I mistakenly believed the above group of species were closely related to the Palearctic *vicrama, baton, abencerragus* group on the basis of my incomplete knowledge of the work of Hemming (1929). This led me to also suggest they were in *Turanana,* a massive error (Mattoni, 1954b). Hemming (1932), unknown to me, had placed the group in *Philotes,* where they remained through Forsters (1938) revision until the work of Henry Beuret. Beuret (1958, 1959) illuminated several relationships by examining most members of the tribe using a taxonomy based on male genitalia and androconia. He erected the new genus *Pseudophilotes,* type species *baton* (Bergstrasser) 1779, to include *vicrama* (Moore) 1865, *abencerragus* (Pierret) 1837, and *bavius* (Evers-

mann) 1832. He also erected *Shijimiaeoides,* type species *divina* (Fixsen) 1887, which included the Tibetan species *lanty* (Oberthur) 1886 and North American *enoptes.*

Forster (1940) had in the meantime (and unknown to Beuret in 1958) corrected the earlier misidentification of *Shijimia moorei* (leech) (*Everini*) with the new entity *Sinia leechi,* Forster, 1940 and included *lanty* and *divina* in *Sinia.*

The Beuret diagnosis of *enoptes* in *Shijimiaeoides* was unnoticed until Shields commenced his comprehensive study on the biology, distribution and variation of North American *Philotes.* Shields (1974) noted Beurets conclusion and applied *Shijimiaeoides* to the North American *enoptes* and *rita,* later including *battoides* (Shields, 1975).

Heretofore I have hesitated to erect new genera without exploring possible relationships within the whole tribe *Scolitantidini* Tutt 1909 (syn. *Glaucopsychini* Hemming 1932, see Beuret 1959). Sufficient morphological data are available which indicate the propriety of doing so now.

Although *S. divina* shares certain morphological features with *enoptes et al.,* and may in fact be the closest relative to the North American group, I believe it quite distinct.

EUPHILOTES MATTONI, NEW GENUS

Type Species: *Lycaena enoptes* Boisduval 1852, Ann. Ent. Soc. France 2 (10) :298

Adult (Table 1, Plates 1, 2, 5, 9, 12)

Head. Antenna 28 segments in male, 30 in female; Club 14-15 segments, nudum 12. Eyes smooth, round in frontal aspect. Frontal ratio eyes to head coverage 69%. Labial pulps erect, densely covered with white scales dorsally and caudally, black hairscales ventrally. Ratio of segments 1 : 3.4 : 1.1, third segment with a terminal notch about half the length.

Wing shape and venation commonplace for the tribe. Venation of forewing radial vein system ratio unique (rf. Plate 10): A/B 0.75, B/C 1.50.

Males with dense androconial scales with average length of .210 mm, width of .149 mm (Ratio 1.4) with 15 striae. Flavone present as the underside ground pigment.

Legs robust L/W Ratio 4.2, pro- and mesothoracic legs with large tibial process and two pairs of short, fine calcaria in both sexes. Ungual edont lobes absent.

Male Genitalia. Tegumen heavy, vinculum light in lateral aspect, relatively compressed cephalo-caudally. Saccus very long. Labides not produced, flat, somewhat broad in caudal aspect (L/W Ratio 2.0). Falces short, relatively fine, tapered, not touching. Aedeagus simple with well developed pair of basal lopes, seminal duct entering dorso-cephalad. Zone almost terminal. Cornuti spines short, coarse, numerous, borne on a single dorsal plate.

Female Genitalia. Papillae anales subtriangular. Posterior aeophyses short, straight, not tapered, attached to papillae anales subdorsally. Lodix large subcuboid formed as a single apparent sclerite. Deeply invaginated into the seventh segment. Corpus bursa simple, elongate, without cervix or signa.

DIAGNOSIS: *Euphilotes* can be differentiated at once from all numbers of the tribe by the single character of venation of R (Table 1). The combination of robust legs, large tibial process, paired calcaria, and antennal segment number of both sexes; and single cornutus plate, absence of Chapmans process on the aedeagus, and short falces in the male are also of generic value.

The conformation of the valves in the male genitalia and lodix and ovipositor in the female, though of highly significant taxonomic value, appear for the most part limited to specific differentiation. In our projected study these and other internal characters will be subject to multivariate analysis to more exactly define phenetic relationships.

The specific sets of characters which serve to define *Euphilotes* and differentiate it from related genera are given in Table I and the cited plates. These data compare *E. enoptes* and its congeners which have been examined, to all other genera in the "red maculed" section of the tribe. In several cases it should be recognized that the evaluations are based on single specimens. Accordingly further study may show several individual aberrant traits. The trends, nevertheless, are fairly clear.

Euphilotes is confined to western North America and includes the species *enoptes, rita, mojave, spaldingi,* and *battoides.* Contrary to the diagnosis of Shields (1975) there is adequate evidence regarding *E. spaldingi* as a distinct species on morphological and biological grounds and *E. mojave* on the basis of several instances of sympatry and cryptic morphological differentiation. These points will be expanded in a forthcoming paper. Pending outcome of a long term project Shields and I are com-

mencing, more complex relationships may be revealed in the future.

The assignment of other related species in this section is fairly straightforward. Both *Philotes* and *Scolitantides* are monospecific. *Pseudophilotes* as a homogeneous set of species clearly defined by the produced labides of the male genitalia. The genus includes *P. baton, P. vicrama, P. abencerragus* and the newly described *P. sinaicus* Nakamura 1974 plus other possible included cryptic species as *panoptes.* (Hbn.) 1808. I have placed *bavius* in *Sinia* on the basis of many shared morphological traits in spite of a somewhat divergent facies (rf. Figs. 2 & 3). Higgins (1975) clearly perceived *bavius* did not belong with *Pseudophilotes,* placing it in *Scolitantides. Shijimiaeoides lanty* has been retained with *S. divina.* Although there are several important divergences, both far eastern species appear more closely related than to any others. Based upon limited data *S. divina* is close to *Maculinea* and may exemplify the link of the "red macule" species to the *Glaucopsyche* section.

The relationships of *speciosa* are not well defined. Although it is not close to *P. sonorensis,* it is also not congeneric with *Euphilotes.* Shields (1974) recognized this fact and placed *speciosa* in *Zizeeria* (Zizeerini) based upon features of the male genitalia and early stages. Although the *Scolitantidini* and *Zizeerini* appear phenetically close, *speciosa* clearly belongs in the former tribe by virtue of gross structure of genitalia, legs, androconia, and probably other factors.

Since Forster (1938) erected *Praephilotes* for *anthracias* and *Paleophilotes* for *triphysina,* claiming these as primitive forms, it appeared fruitful to include the duo in an analysis as possible relatives of *speciosa. P. arthracias* is a common butterfly in the Karakum Desert, *P. triphysina* a virtually unknown inhabitant of the Sikiang steppes. Neither appears close to *speciosa,* nor, based on the data given, to any other members of the group, including one another. *P. triphysina* is particularly bizarre (Table I and Figures) with regard to venation; male genitalia with the laterally bent aedeagus and deeply involuted ductus entry, strongly produced labides, heavy long bent tegumen, a complex bifurcate juxta, and a definative sclerite surrounding the anal opening. In particulars of the male genitalia there are some suggestions of relationship to *Pseudophilotes.* The facies of both *P. triphysina* and *P. anthracias* are decidedly Zizeerine. *P. anthracias* otherwise appears closer to the Scolitantidid groups. I have concluded accordingly, that *speciosa* requires a new genus.

PHILOTIELLA MATTONI, NEW GENUS

Type Species: *Lycaena speciosa* Henry Edwards, 1876 Proc. Cal. Acad. Sci. 7:173

Adult (Table 1, Plates 3, 4, 5, 10, 12)

Head; antenna 29 segments in male, 30 in female; Club 13 segments, nudum 10. Eyes smooth, round in frontal aspect. Frontal ratio of eyes to head coverage 64%. Labial palps erect, densely covered with hairscales ventrally and scales dorsally. Both scale types white basally and black proximally. Ratio of segments 1 : 2.5 : 0.8, third with small terminal notch.

Forewing. Shape commonplace Scolitantiidid but slightly more elongate (L/W 1.85 vs 1.75 for. *Euphilotes enoptes*). Venation commonplace, except branch of $R_4 + _5$ from R_3 more distad than any other genera in the group excepting *P. triphysina.*

Hindwing. Shape and venation commonplace for the tribe.

Males possess abundant androconial scales with an average length of .178 mm, width of .126 mm and 13 striae, ratio 1.4). Flavones present as underside ground pigment.

Legs unique for the tribe, femur more robust than any of the tribe with L/W ratio 3.0. Proleg with very large tibial process and one pair of short fine calcaria in both sexes. Tibial processes absent on meso- and metathoracic legs. Ungual edont lobes absent.

Male genitalia unique for the tribe. Tegumen and vinculum heavy in lateral aspect, saccus absent, labides not produced, flat, suboval in caudal aspect (L/W Ratio 1.3). Falces short, heavy except distally terminating in fine apical processes bending posteriad and ventrad and parallel with one another. Juxta straight in lateral aspect, relatively short. Aedeagus unique in possessing a quadrilobed base. Seminal duct entering dorso-cephalad. Zone almost terminal. Vesica slender bearing few small blunt, coarse cornuti spines.

Female genitalia. Papillae anales subquadrate with the membranous setal caudal portion almost exactly bisecting the quadrate form. Posterior apophyses short, tapered and bent, jointing the papillae anales subdorsally. Lodix subcylindrilar in caudal view, formed of two sclerites, the ventral appearing the smaller

PLATE 1
Uppersides. Row 1 (Males) and 2 (Females) Left to Right. *Shijimaeoides divina asonis,* Mt. Aso, Kyushu, 24 May, 1970, leg. Setoya and Takagi; *Shijimiaeoides lanty lanty,* Tatsienlu, Szechwan, Cheto-Wahui P. 10 May 1930 (ZSB), *Sinia bavius bavius,* Male, Kohu Mts., Anatolia, 5 May, 1976, leg. Gillet; Row 3 (Males) and 4 (Females). *Sinia leechi,* Sunpanting, Szetchwan, no date, Stotzner Exp. (ZSB); *Scolitantiides orion,* Srbeko, Bohemia, 7 May, 1967, leg. Vanek; *Pseudophilotes vicrama astarene,* Djrezh River, Yerevan, Armenia SSR, 1000 M, 4 June, 1972, leg. Weidenhoffer; *Euphilotes enoptes enoptes,* Male, Tioga Pass, Mono Co., Calif., 14 July, 1958, leg. Shields, Female west above Tioga Pass, Mono Co., Calif., 27 July, 1960, leg. Shields.

PLATE 2
Undersides of PLATE 1.

PLATE 3
Uppersides. Top Row, *Philotiella speciosa speciosa,* Male, Randsburgh, Calif., 4 May, 1954, leg. R. Ford; Female, Mojave Desert, Calif., 12 May, 1924, leg. J. A. Comstock; *Philotiella speciosa bohartorum,* Briceburg, Calif., 10 May, 1969, leg. J. Lane. Second Row, *Paleophilotes triphysina,* Male and Female, Altyn Tag, China, Turkestan, no date (ZSB). Third Row, *Praephilotes anthracias,* both males, Repetek, Transcaspian, 4 April, 1966 (ZSB); Kuldaha, Thien-Shan, 1885 (ZSB).

PLATE 4
Undersides of PLATE 3.

of the two. The lodix is only slightly invaginated into the seventh segment. Corpus bursa simple, elongate, without cervix or signa. DIAGNOSIS: *Philotiella* can be distinguished from other closely related genera by the single character of venation of R (Table I). The extremely heavy proleg femur is also unique. Although the ratio is given for the male (Table I) the female is virtually identical. The large tibial process of the prothoracic legs in contrast to a small process on the mesothoracic legs is also unique. The aedegus likewise exhibits characters found only in this genus: the relative overall length and the four lobed base.

The pattern of variation in the *Scolitantidini* is complex, probably because of an evolutionary history with both substantial radiation and convergence. Monophyletic (monophenetic) lines are difficult to recognize at this time. With data on more characters, including early stages, we hope to perform multivariate analysis in order to quantitate possible phenetic distances.

It is intriguing to speculate that the center of origins of the tribe lies in the vicinity of the North Eastern Tibetan plateau. In the area of western Szechwan the following genera are represented: *Glaucopsyche, Sinia, Shijimiaeoides, Maculinea, Phengaris, Caerulia* and *Scolitantides.* Within a distance of 2000 km to the west and north, all remaining Palearctic genera are to be found: *Paleophilotes, Praephilotes, Pseudophilotes, Turanana,* and *Iolana.* Included with the latter group is *Lycaena panope,* Eversmann 1851, which cannot be generically assigned at this time; and a new genus and species from the Koh-I-Baba Mountains of Afghanistan which appears close to *Turanana. Pseudophilotes* and *Euphilotes* appear to represent a case of convergence in facies following adaptive responses towards the Mediterranean west and east into North America. Both genera appear actively evolving in adapting to the conditions of their respective habitats to this day. Such a situation would account for the taxonomic dynamism of the genera at this point in the biological history of the earth.

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Takashi Shirozu of Kyushu University, Japan for donating a beautiful series of *S. divina*, to John Lane, University of California, Davis, for providing the *P. speciosa bohartorum* specimen used, to John Sorensen for providing the manuscript of his invaluable morphological study, to Julian Donahue of the Los Angeles Museum of Natural History by always making their collection and library completely available, and last but not least, to my colleague Oakley Shields for the many discussions on this group we are so deeply committed to study.

Location of Figured Material: (ZSB) from the Zoologische Sammlung Des Bayerischen Staates, Munich, Germany. All others from the Los Angeles Museum of Natural History. Prepared material will accompany their specimens.

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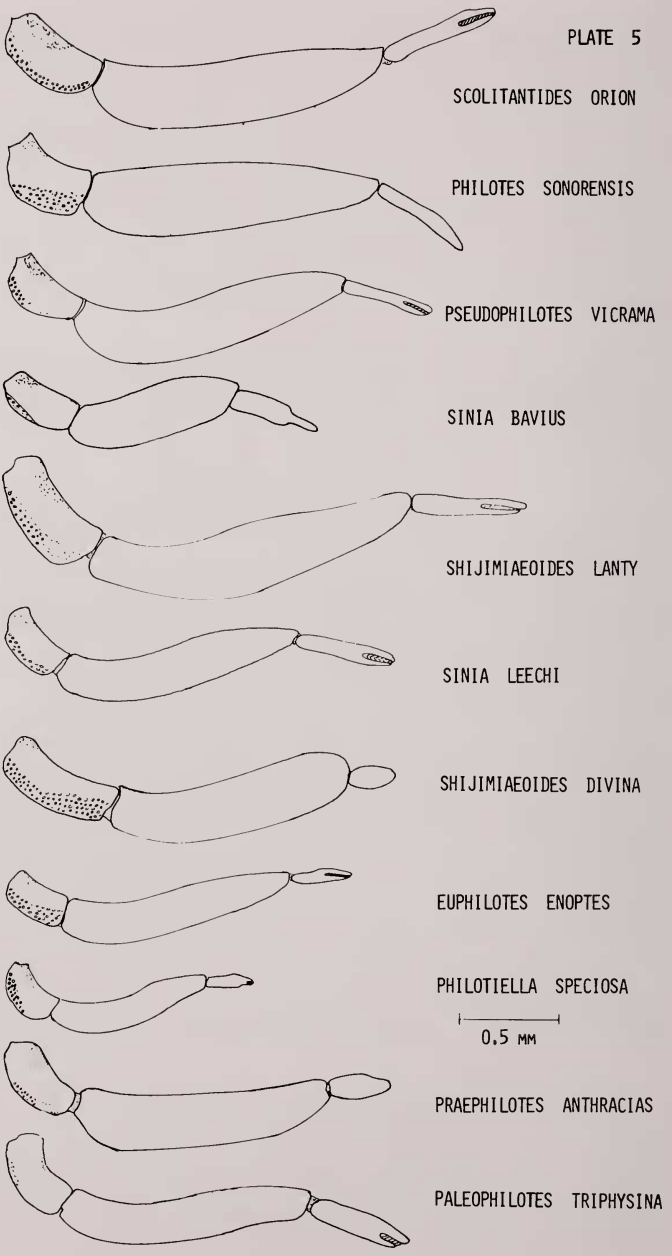


PLATE 5
Labial palps of eleven species as labelled, scale indicated.

All illustrations, with exception of the venation diagram, to the same scale. Execution using a Wild M5 Microscope with the Wild Drawing Attachment, by R. H. T. Mattoni.

PLATE 6

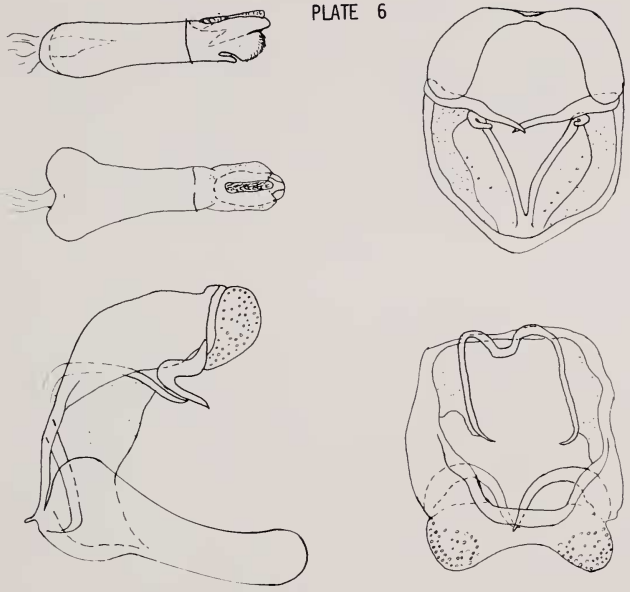


PLATE 6
Male genitalia of *Scolitantiides orion* (above); *Philotes sonorensis* (below).
Upper left figures: Aedeagus, lateral view (above); dorsal view (below).
Upper right figures: entire genitalia with valves not shown, caudal view showing relative shape or labides and falces.
Lower left figures: entire genitalia lateral view.
Lower right figures: entire genitalia with valves not shown, dorsal view, caudally oriented to bottom of plate.

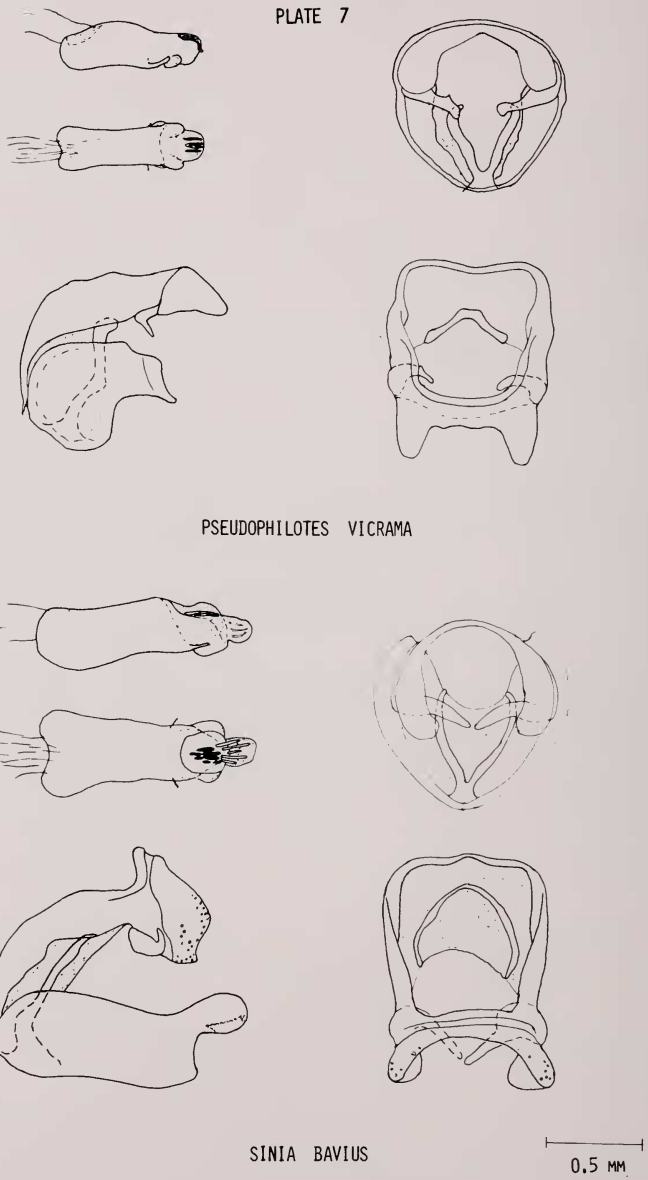
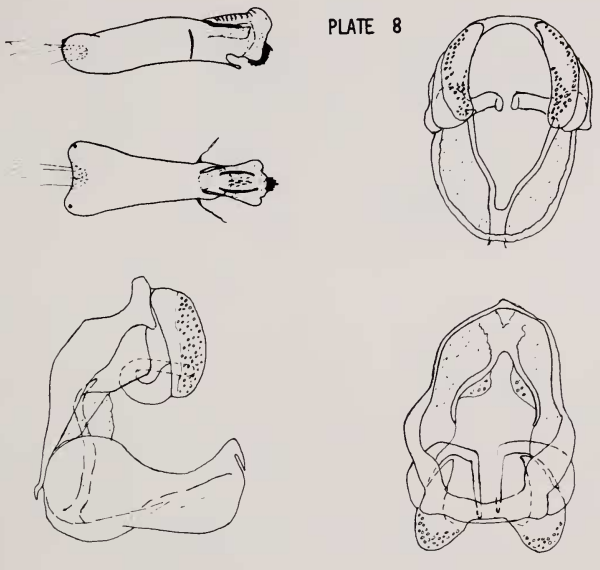


PLATE 7
Male genitalia of *Pseudophilotes vicrama* (above) and Sinia bavius (below) orientation as PLATE 6.



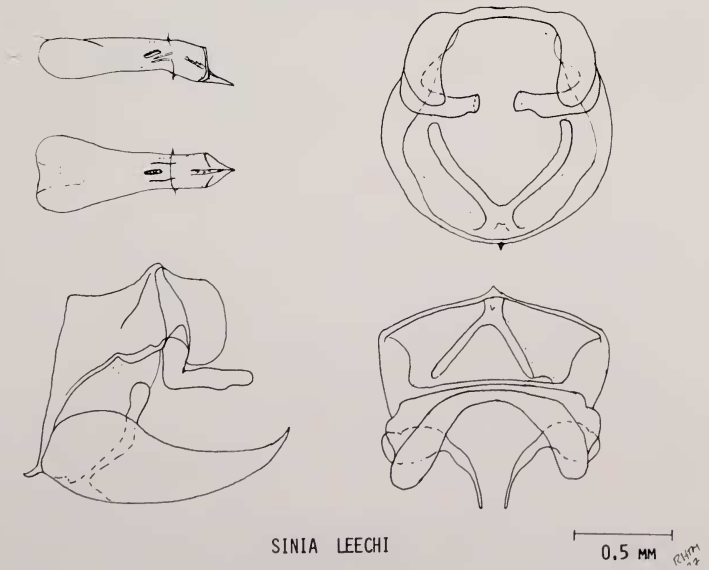


PLATE 8
Male genitalia of *Shijimiaeoides lanty* (above) and *Sinia leechi* (below) orientation as PLATE 6.

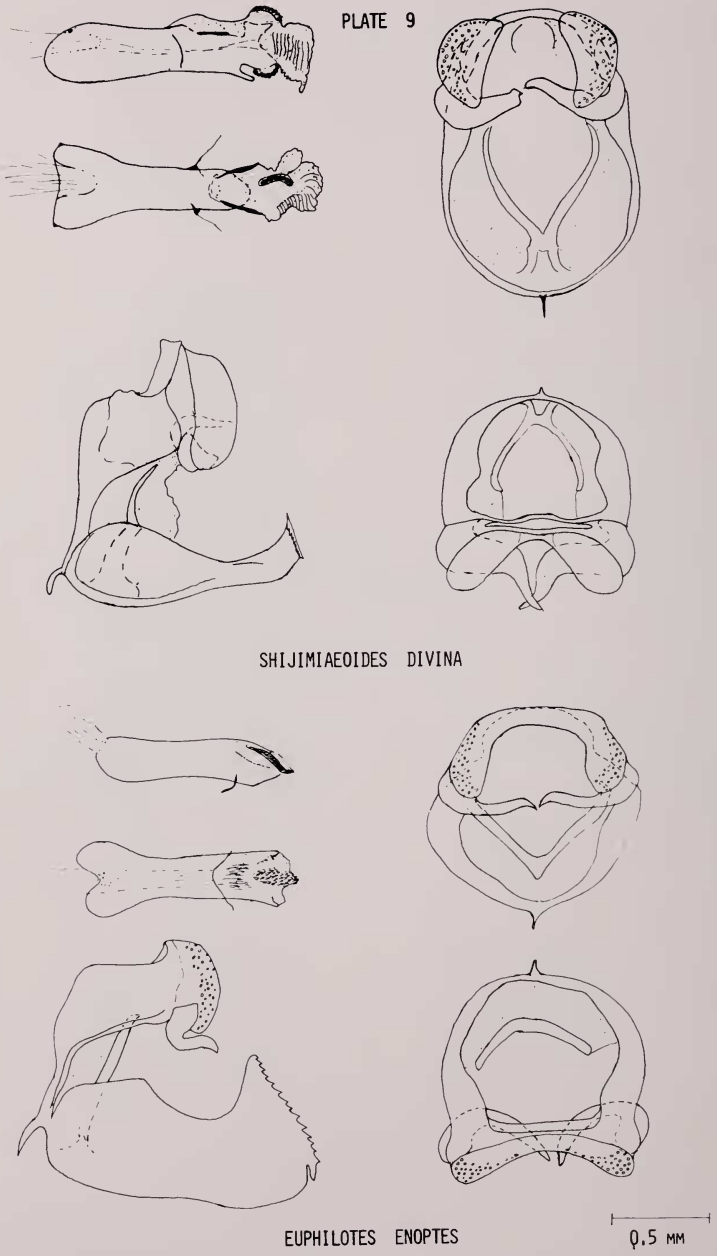
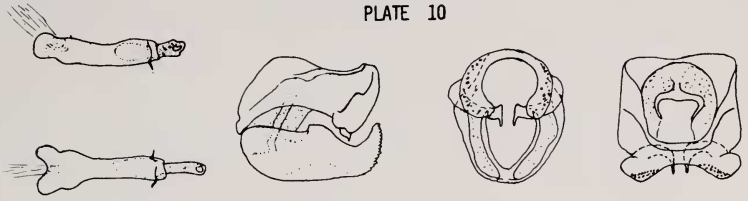
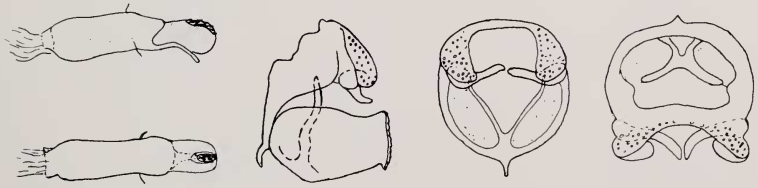


PLATE 9
Male genitalia of *Shijimiaeoides divina* (above) and *Euphilotes enoptes* (below).

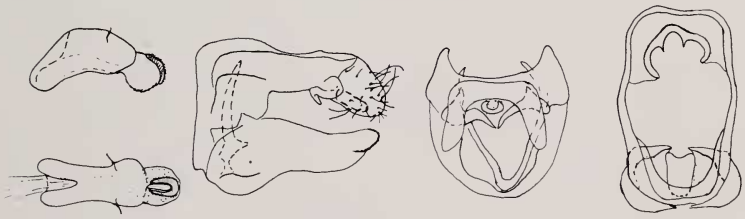
PLATE 10



PHILOTIELLA SPECIOSA

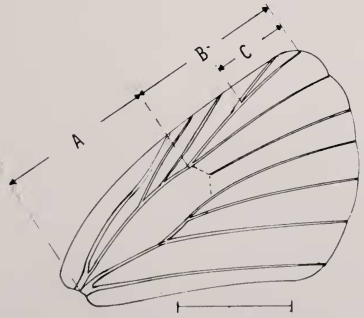


PRAEPHILOTES ANTHRACIAS

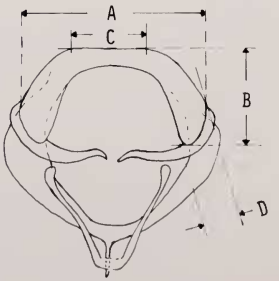


PALEOPHILOTES TRIPHYSINA

0.5 MM



5.0 MM



0.5 MM

PLATE 10

Male genitalia of *Philotiella speciosa* (above), *Praephilotes anthracias* (second row) and *Paleophilotes triphysina* (third row). Aedeagus lateral and dorsal views to left, entire genitalia next, entire genitalia without valves shown caudal view, and lastly, entire genitalia without valves, dorsal view. Lower figures giving (left) forewing venation of *S. orion* to show measurement for relative distance ratio determinations of R to R_3, base of R_3 to margin, and distal length $R_4 + _5$ to margin. Lower figure (right) caudal view of male genitalia of *E. enoptes*, not showing valves, indicating areas measured to describe the labides. In this paper only the ratio of A/B is given.

PLATE 11

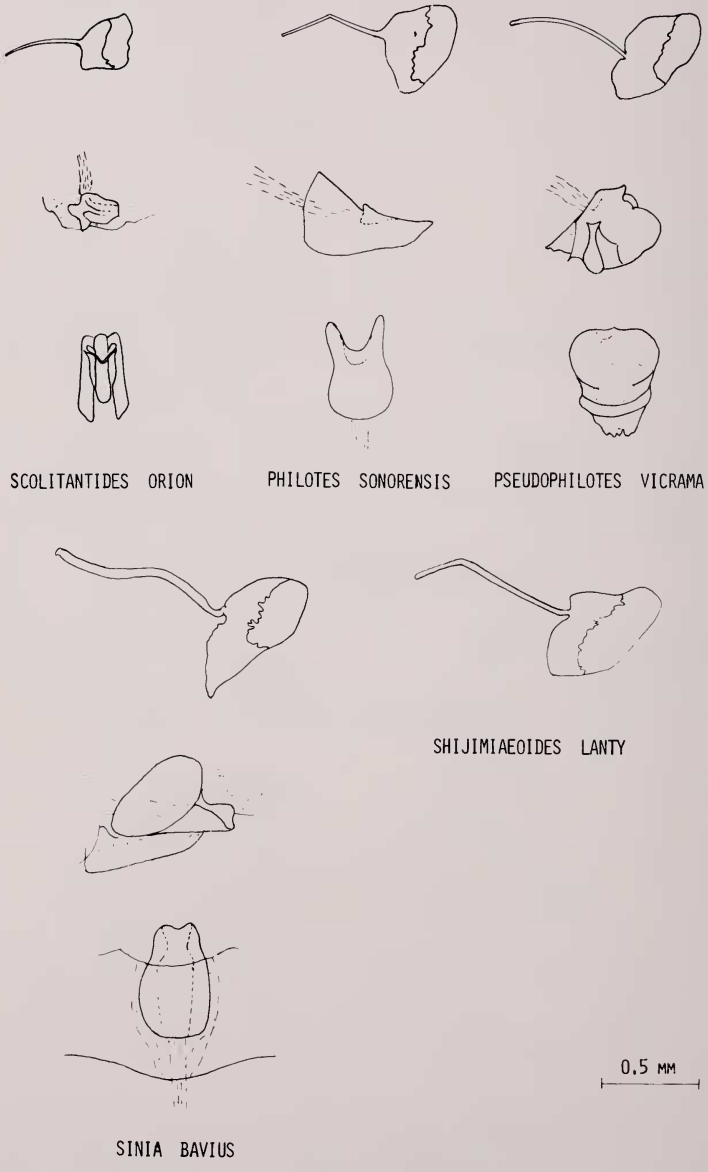


PLATE 11
Female genitalia of *S. orion, P. sonorensis, P. vicrama, S. bavius,* and *S. lanty.* Upper figure of each depicts the papilla anale and posterior apophysis in lateral view. Middle figure shows the lodix in lateral view oriented with the ostium vaginalis to the right. The course of the ductus bursa indicated by broken lines. The lower figure shows the lodix from the ventral view. The specimen of *S. lanty* had lost its lodix.

PLATE 12

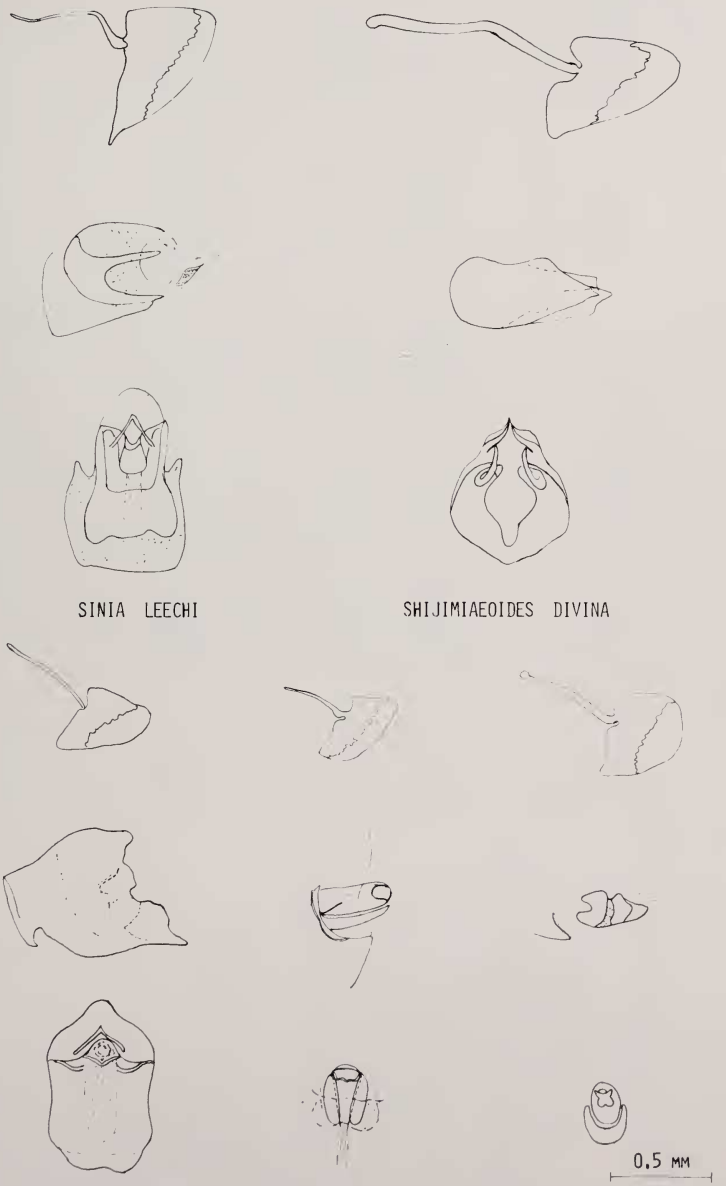


PLATE 12
Female genitalia of S. *leechi*, S. *divina*, *E. enoptes*, *P. speciosa*, and *P. triphysine*. Orientation as in PLATE 11.

TABLE I

MORPHOLOGICAL DATA FOR RELATED TYPE SPECIES AND SOME OTHER SPECIES IN THE SCOLITANTIDINI

	SCOLITANTIDES ORION	PHILOTES SONORENSIS	PSEUDOPHILOTES VICRAMA	SINIA BAVIUS	SINIA LEECHI	SHIJIMIAEOIDES LANTY
No. Antenna Segments ♂/♀	35/34	35/34	33/31	33/32	33/34	34/33
Ratio Segments 1:2:3 Labial Palps	1.0:3.0:1.2	1.0:2.5:1.0	1:3.6:1.3	1:2.2:1.2	1.0:3.6:1.5	1.0:2.9:1.0
Eye Hairs	0	0	+	+	+	+
Flavone Pigment (undersides)	+	0	+	+	0	+
Androconia L/W if present	None	None	1.4	1.8-2.4	1.6	1.2
Ratio A:B, B:C Venation[1]	1.05/2.00	1.05/1.55	1.05/1.90	1.05/1.75	1.05/2.00	1.05/1.75
Ratio ♂ Proleg Femur:Tibia:Tarsus	1.0:0.9:1.0	1.0:0.8:0.9	1.0:0.8:0.9	1.0:0.9:1.1	1:0.8:0.7	1.0:0.8:0.9
♂ Proleg Femur L/N	5.0	4.5	5.9	5.6	6.5	4.8
Ratio Femur:Tibia,Meso/Meta Legs	0.78/1.07	0.66/1.13	0.74/1.04	0.65/1.09	N.A./1.00	0.88/0.97
Tibial Process Pro & Meso Legs	Large/Large	None/Small	Minute/Minute	None/None	None/None	Small/Small
No. Pair of Calcaria, ♂ Proleg	1	1	2	1	2	2
Calcaria Shape	Short/coarse	Short/fine	Long/fine	Short/fine	Short/fine	Short/fine
Endodont Lobes	0	0	0	0	0	0
Aedeagus (Expanded) L/W shaft/w base	5.4:2.5	7.1:3.1	4.2:3.2	3.7:2.4	5.6:2.5	5.5:2.7
Chapmans Process	0	+	0	0	0	+
Basal Lobes	Well dev.	Well dev.	Poor	Well dev.	Weak lobed	Weak lobed
Cornuti Spines	Fine small	Fine small few	Fine small	Few long-coarse	Short-coarse	Few long-coarse
Lateral Form Juxta[2]	2	1	1	0	1	1

Saccus	+	+	+	0	+	+
Labides L/W[1]	2.0 blunt	1.7 blunt	2.4 blunt	1.4 blunt	1.9 blunt	1.3 blunt
Falces Form & Relationship	long/cross.	long/cross.	short	short	long/parallel	long/parallel
Shape Corpus Bursa	elongate	elongate	elongate	elongate	sub-elongate	elongate
Cervix Bursa	+	+	0	0	0	0
Sigma Bursa	+	+	0	0	0	0
Posterior Apophyses						
L/Max. Dimension Papillae anales	1.05	0.90	1.30	1.10	0.85	1.35
Form	bent/no taper	bent/ tapered	straight/no taper	straight/no taper	bent/tapered	straight/no taper
Attachment to Papillae anales	medial	dorsal	medial	dorsal	dorsal	dorsal
Shape Papillae anales	quadrate	quadrate	quadrate	quadrate	triangular	quadrate
Foodplant	crassulaceae	crassul- aceae	Thymus/ Labiatae	Salvia/ Labiatae	no data	no data

1. See Plate 10
2. 0 straight, 1 slight curve, 2 strong s curve

	SHIJIMIAEOIDES DIVINA	EUPHILOTES ENOPTES	PHILOTIELLA SPECIOSA	PRAEPHILOTES ANTHRACIAS	PALEOPHILOTES TRIPHISINA
No. Antenna Segments ♂/♀	34/35	28/30	29/30	33/N.A.	36/35
Ratio Segments 1:2:3 Labial Palps	1:2.1:0.4	1:3.4:1.1	1:2.5:0.8	3.3:0.7	1.0:2.9:1.0
Eye Hairs	+	0	0	0	0
Flavone Pigment (undersides)	0	+	+	0	0
Androconia L/W if present	1.2	1.4	1.4	none	none
Ratio A:B, B:C Venation[1]	0.80/2.30	0.75/1.50	1.05/2.60	1.25/1.75	1.05/3.65
Ratio ♂ Proleg Femur:Tibia:Tarsus	1:0.8:1.2	1:0.8:1.0	1:0.7:1.3	1.0:0.8:1.0	1.0:0.9:0.9
♂ Proleg Femur L/N	4.1	4.2	3.0	3.5	4.1
Ratio Femur:Tibia,Meso/Meta Legs	0.70/1.10	0.73/1.00	0.74/1.08	0.80/1.11	0.75/1.06
Tibial Process Pro & Meso Legs	Very Lg/Very Lg	Large/Large	Large/Small	Large/small	None/none
No. Pair of Calcaria, ♂ Proleg	1	2	1	1	1
Calcaria Shape	Long/coarse	Short/fine	Short/fine	Short/fine	Short/fine
Endodont Lobes	+	0	0	0	0
Aedeagus (Expanded) L/W shaft/w base	6.2:3.0	3.2:2.7	7.8:3.6	5.0:6.0	4.5:3.6
Chapmans Process	0	0	0	0	0
Basal Lobes	Weak lobed	Well dev.	2 pairs dev.	None-tapered	Slight dev.
Cornuti Spines	2 sets small-coarse	Coarse-small	Few coarse-small	Fine-small	Fine-small
Lateral Form Juxta[2]	0	0	0	0	0
Saccus	++	++	0	++	0
Labides L/W[1]	1.8 blunt	2.0 blunt	1.3 blunt	2.1 blunt	1.5
Falces Form & Relationship	long/cross.	sht/not cross	sht/parallel	sht/not cross	sht/not cross
Shape Corpus Bursa	elongate	oblong	elongate	no data	round
Cervix Bursa	0	0	0	no data	0
Sigma Bursa	0	0	0	no data	0
Posterior Apophyses L/Max. Dimension Papillae anales	1.56	1.00	1.05	no data	1.00
Form	bent/no taper	straight/no taper	bent/tapered	no data	straight/no taper
Attachment to Papillae anales	medial	dorsal	dorsal	no data	dorsal
Shape Papillae anales	triangular	triangular	triangular	no data	quadrate
Foodplant	Sophora/ Leguminosae	Eriogonum	Eriogonum/ Oxytheca	no data	no data